DYNAMICS OF THE ULTRASTRUCTURAL CHANGES OF MOUSE THYMUS EPITHELIAL CELLS AFTER L-3,3',5-TRIIODOTHYRONINE TREATMENT

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The process of thymus humoral factor synthesis (THF) (most of these factors are of polypeptide-protein nature) by thymus epithelial cells is not investigated enough yet (1—3, 6, 7, 10, 15). The knowledge about the character and dynamics of the changes of thymus epithelial cell ultrastructure caused by exogenous triiodothyronine provides new possibilities for studying and medicamentous influencing on protein-synthesizing function of these cells corresponding to THF synthesis. That is why we decided to perform the present study.

Material and methods

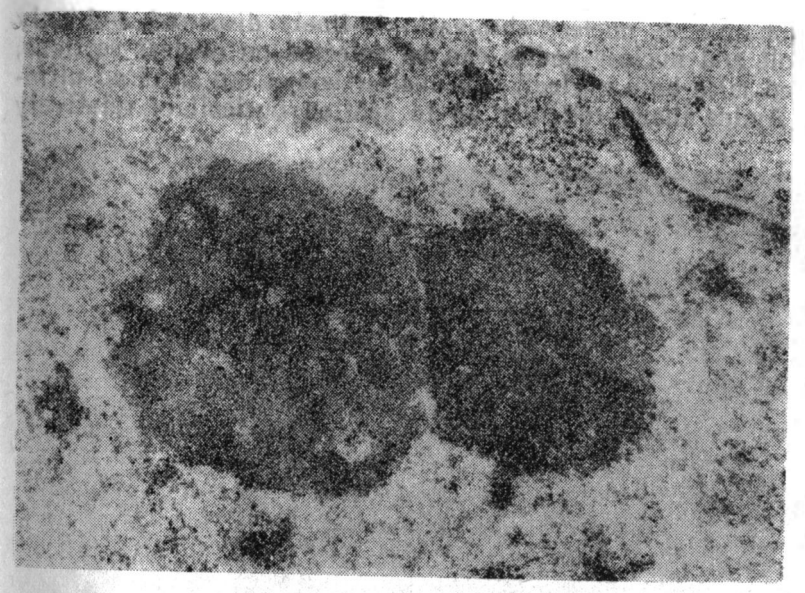
The investigation was carried out on material from thymuses of 12 conventional mice of both sexes aged 3 months (b. w. of 20 g). 9 of the animals were intraperitoneally injected with L-3,3',5-Trijodthyronin (Berlin-Chemie) after the method of J. Scheiff et al. (14) at the dosis of 6 mkg/100 g b. w. diluted in saline (once daily for one week and then every third day for one month). Three control animals were injected with saline only. Material was taken from triiodothyronine-injected animals on the 14th day after the begin of the experiment (from 4 animals) and on the 28th day (from the rest 5 ones). It was then processed after a routine method for electron microscope examination (5). Ultrathin sections were contrasted after E. Reynolds (13) and observations were made on electron microscope JEM 7A.

Results and discussion

Thymic lobes of both control and triiodothyronine-injected mice are divided by connective tissue bands into thymic lobules with well-formed cortex, cortico-medullary transition and medulla. A variety of morphological types of epithelial cells is observed. They possess together with common and constant signs (relatively large nucleus, desmosomes, intermediate filaments and microvilli and/or cilia, contact to basal membrane) also certain regional ultrastructural differences related to the relative part and distribution of the cytoplasmic organelles (5).

In contrast to control animals, triiodothyronine-treated mice demonstrate in some of the thymus epithelial cells equal in character ultrastructural changes affecting the same cell organelles — nucleus, endoplasmic reticulum, cytofilaments, lysosomes, and desmosomes. The fact strikes that these changes differ in the animals examined on the 14th day as compared with those in the animals examined on the 28th day.

On the 14th day after the begin of hormonal influence, ultrastructural alterations can be seen in the nucleus, endoplasmic reticulum and epithelial cell cytofilaments.



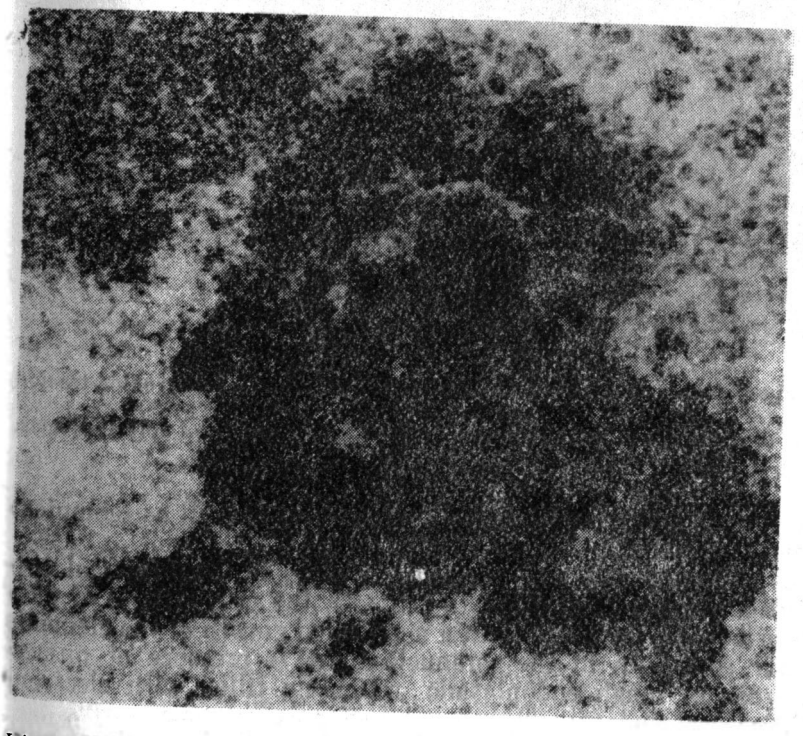


Fig. 1. Fig. 2. Reticular nucleoli with differently organized perinucleolar heterochromatin in two thymus epithelial cells of triiodothyronine-treated conventional mice.
Fig. 1. Magnification 17 000 ×.
Fig. 2. Magnification 30 000 ×.

While in control animals nuclear chromatin is finely dispersed and only exceptionally nucleoli and nuclear bodies can be detected on nuclear sections, in hormonally-treated mice both nucleoli and nuclear bodies are an often ultrastructural finding. Amids them, reticular up to spotted nucleoli of relatively

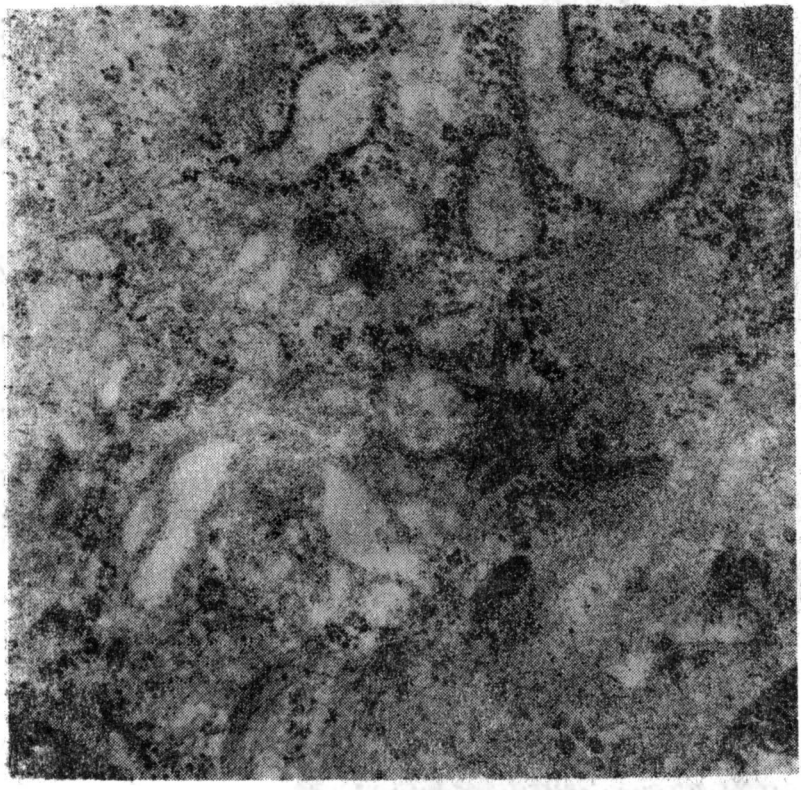


Fig. 3. A part of the cytoplasm of thymus cortical epithelial cell of triiodothyronine-treated conventional mouse.
Region rich in elements of the rough endoplasmic reticulum, Golgi complex and polyribosomes. Magnification 20 000 ×.

large size and differently organized perinucleolar chromatin as well as «complex» nuclear bodies prevail (fig. 1, 2).

In some thymus epithelial cells and particularly often in some cortical epithelial cells of animals treated, in contrast to controls, the peculiarities of nuclear morphology described are combined with a manifested growth of the elements of rough endoplasmic reticulum in the paranuclear area — presence of numerous dilatated cisternae of rough endoplasmic reticulum filled with electron-dense finely floculated material (fig. 3) and a lot of polyribosomes.

In thymus epithelial cells of triiodothyronine-treated mice by contrast with the control ones numerous intermediate filaments can be observed. The latter are organized in bundles located most frequently in the close proximity of cisternae of rough endoplasmic reticulum and occupy relatively large in size cytoplasmic areas.

On the 28th day after the beginning of the experiment in thymic epithelial cells of hormonally treated animals ogether with the ultrastructural features

described above certain peculiarities of the morphology of the vacuolar apparatus and desmosomal contacts of the cells can be seen. Golgi vesicles and vacuoles as well as primary lysosomes prevail in the epithelial cells of control animals. In contrast to them, however, there is an increase of the relative share of secon-

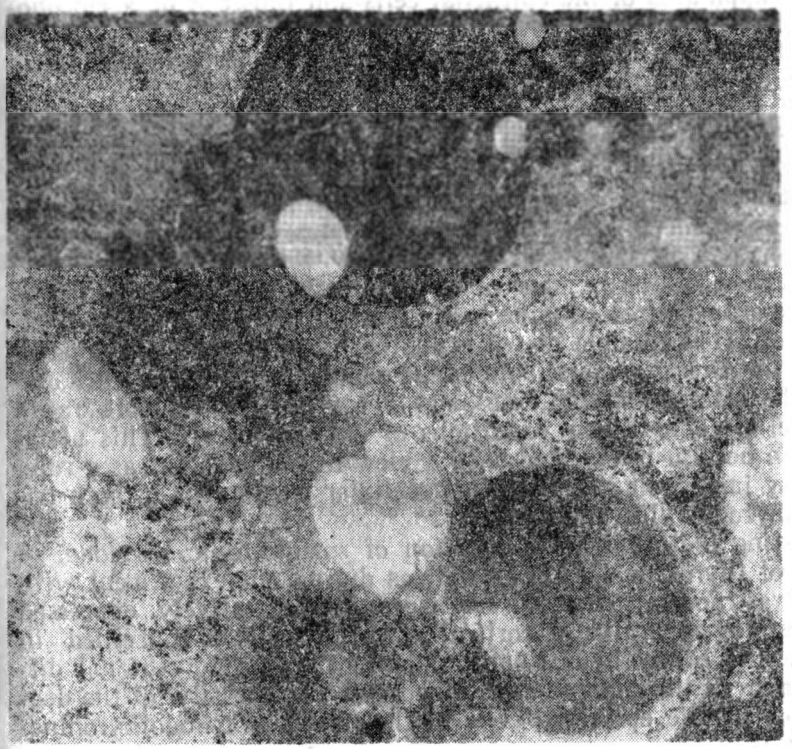


Fig. 4. Numerous electron-dense bodies in the cytoplasm of mouse thymus cortical epithelial cell after triiodothyronine treatment. Magnification 20 0^0 ×.

dary lysosomes with prevailing electron-dense bodies in hormonally treated animals (fig. 4). These bodies strike not only by their relatively great number but also by their large size. Most electron-dense bodies possess heterogeneous substructure and are particularly often found out in cortical epithelial cells.

While in control animals single desmosome contacts connect neiborough epithelial cells, in triiodothyronine-injected mouse thymus epithelial cells can be observed containing several, closely to each other located desmosomes. This ultrastructural finding is particularly characteristic for thymic cortical epithelial cells.

In the course of our investigation we have chosen the method of J. Scheiff et al. (14) proposed for hormonal treatment by low doses of triiodothyronine because this method is conformed to some specific peculiarities of the biological activity of thyroid hormones — long latent period, summation of the action, dose-effect dependence (4, 8). Our results obtained demonstrate equal in character but different in dynamics alterations of corresponding organelles of thymus epithelial cells of animals treated. Ultrastructurally, changes of the morphology of the nucleus, endoplasmic reticulum and cytofilaments are earlier detectable and more considerable (on the 14th day after the beginning of the experiment).

The same changes are later, on the 28th day after the beginning of the hormonal influence, accompanied also by changes of lysosomes and desmosomes of the epithelial cells.

Some of the changes observed essentially present a transformation of the protein-synthesizing apparatus of the epithelial cells and thus can be a morphological basis for a more intensive RNA and protein synthesis in corresponding epithelial cells as it has been alreaIy established by other investigators concerning hepatocytes from triiodothyronine-injected rats (8).

The question if relative increase of the number of intermediate filaments is related with their more active engaging in the process of liberation of biologically-active substances synthesized in epithelial cells as supposed by Yu. P. Chernenko (9), or it is still another result (together with desmosome count increase) from the morphogenetic effect of thyroid hormones (8, 9) remains still open.

The relative increase of the number of telolysosomes in a part of thymus epithellal cells of the animals treated is probably related to the processes of THF synthesis and secretion. It is possible that it is another manifestation of the pathway well-known in the literature available of some biologically-active substances synthesized in the cells — through lysosomes — contributing to more rapid adaptation of epithelial cells to new conditions of exposition (11). This ultrastructural finding can be also interpreted with a view to the fact that as a rule, lysosomes play a very important role in the intracellular metabolism of both triiodothyronine and thyroglobulin (2, 6).

It is an interesting fact that after injection of somatotropic hormone, of corticosteroids, and of thyroxine (7, 12) as well as during our experiment with triiodothyronine ultrastructural changes are more demonstratively expressed when protein-synthesizing apparatus of cortical epithelial cells is concerned in comparison with these in other thymus parts. This fact argues for regional differences of the dynamics of the changes ascertained and, respectively, of the degree of commitment of thymic epithelial cells in the process of triiodothyronine-induced THF synthesis.

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ДИНАМИКА ИЗМЕНЕНИЙ В УЛЬТРАСТРУКТУРЕ ЭПИТЕЛИАЛЬНЫХ КЛЕТОК ВИЛОЧКОВОЙ ЖЕЛЕЗЫ У МЫШИ ПОСЛЕ ВОЗДЕЙСТВИЯ L-3, 3^1,5-ТРИИОДТИРОНИНОМ

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РЕЗЮМЕ

При помощи стандартной электронно-микроскопской техники исследованы характер и динамика изменений в ультраструктуре эпителиальных клеток вилочковой железы конвенциональных мышей, после воздействия I-3,3′,5-трииодтиронином по методу J. Scheiff (1977). На более раннем этапе после начала эксперимента ($14^{ый}$ день) установлены изменения ультраструктуры ядра, элементов гранулированного эндоплазматического ретикулума и цитофиламентов, которые впоследствии ($28^{й}$ день) сопутствуются изменениями ультраструктуры лизосом и десмосомных контактов эпителиальных клеток. Полученные данные о преустройстве белково-синтезирующего аппарата преимущественно кортикальных эпителиальных клеток свидетельствует о региональных различиях в динамике ультраструктурных изменений в степени вовлечения эпителиальных клеток вилочковой железы в процесс синтеза ТГФ после воздействия трииодтиронином.